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ABSTRACT

The outline of mathematics skills provides for individualized instruction by allowing each student to complete performance tests which indicate the point at which his instruction should start. The course is divided into two parts; one covering operations with whole numbers, decimals, fractions, and percentage; the other dealing with ratio, proportion, square roots, fundamental geometry, and trigonometry with practical applications. The skills in part one are prerequisite to successful completion of part two which meets the performance requirements of the second class machinist classification. The outline contains lists of texts for both parts on which the skills and assignments are based and a pretest for proficiency credit for part one. The course is structured in units (13 in part one, 10 in part two) which are divided into lessons. For each lesson specific performance objectives with corresponding assignments from the texts are indicated. Quizzes for some lessons and tests for each unit (actual forms) are included. An evaluation form for each unit has space for lesson, quiz, and unit test grades and a percentage formula for using these three types of scores in tabulating a final grade. (MS)

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STATE OF NEW JERSEY
DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL EDUCATION

APPLIED MATHEMATICS
· MACHINE SHOP

A TEACHERS GUIDE

BEHAVIORAL OBJECTIVES
INDIVIDUALIZED CURRICULUM

GEOPHYSY

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State of New Jersey
Department of Education
Division of Vocational Education

APPLIED MATHEMATICS - MACHINE SHOP

A Teachers Guide

Behavioral Objectives
Individualized Curriculum

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INTRODUCTION

MACHINE SHOP
APPLIED MATHEMATICS I

The following is a performance outline for Machine Shop Mathematics I. Each student must demonstrate a capability in all the performances listed to complete the course. These math skills will equip the student to make the necessary calculations for machine tool operation, for personal needs, and as a prerequisite to Machine Shop Mathematics II.

The outline is constructed for individual instruction. All students will start the course by completing tests until they reach their present level of performance. Each individual's instruction will start at that point and continue until he has mastered the performances outlined. Completion of this course of study will permit the student to pursue Machine Shop Mathematics II or take the option of other electives.

Much of the learning will be under the student's own direction. His progress will depend largely on his personal effort and ability. Each class member is expected to give his best effort, using class time to maximum advantage. The benefit each student receives from the instructor's guidance, advice, and knowledge will depend to a large degree on a mature attitude on the part of each individual and the class as a whole.

The student must be convinced that the level of his math skills will have a direct impact on his shop progress. The Machine Shop course relies strongly on knowledge of math and other related subjects. Specific shop performance requirements cannot be met without these background courses.

This course should be an easy step-by-step learning process that should be easily mastered by the conscientious and able student. When he has mastered his related and shop skills, he will be recommended for a trial "earning" in the trade. Remind the students: "You 'learn so that you may earn'".

REFERENCE MATERIALS
FOR
COURSE OF STUDY OUTLINE
MACHINE SHOP
APPLIED MATHEMATICS I

1. *Basic Mathematical Skills* (BMS)
   Loyce C. Gossage
   McGraw-Hill Book Company

2. *Mathematics for Technical and Vocational Schools*
   Stade, Margolis & Boyce
   John Wiley and Sons, Inc.

3. *Basic Vocational Mathematics I*
   C. M. Santoli
   Vocational-Technical Curriculum Laboratory
   Rutgers - The State University

4. *Essential Business Mathematics* (EBM)
   Llewellyn R. Snyder
   McGraw-Hill Book Company

5. *Business and Consumer Arithmetic* (B&CM)
   Olson and McNelly
   Prentice Hall, Inc.

Name_____

Date_____

PRETEST

Machine Shop Applied Mathematics I

NOTE TO STUDENT: To earn credit for Math I, proficiency must be shown in all sections.

A. Reduce to lowest terms: Answer below:

1. 14/16 1._____
2. 24/32 2._____
3. 6/8 3._____
4. 3 10/16 4._____
5. 16/64 5._____

B. Convert to the required fraction:

6. 1/2 to 4ths 6._____
7. 1/2 to 10ths 7._____
8. 3/8 to 32nds 8._____
9. 5/8 to 64ths 9._____
10. 7/8 to 16ths 10._____

C. Add and reduce to lowest terms:

11. 1/2 + 1/4 11._____
12. 3/16 + 1/8 12._____
13. 1 1/4 + 1/4 13._____
14. 7/8 + 1/16 14._____
15. 10 1/8 + 1/32 15._____

D. Multiply and reduce to lowest terms:

16. 3/4 x 5 16._____

17. 2/3 x 5/7 17._____

18. 3/4 x 8/9 18._____

19. 8/11 x 5/12 19._____

20. 2 1/2 x 3 1/4 20._____

E. Divide and reduce to lowest terms:

21. $\frac{5/7}{3/4}$ 22. $\frac{2/3}{5}$ 21._____

22._____

23. $\frac{1\ 1/2}{2}$ 24. $\frac{3}{1/2}$ 23._____

24._____

25. $\frac{7/8}{1/4}$ 25._____

F. Give the decimal equivalent correct to 3 decimal places:

26. 3/4 26._____

27. 5/16 27._____

28. 1 5/8 28._____

29. 1/32 29._____

30. 1/64 30._____

G. Add. Give answers in decimals.

31. 1.500 + .250 - .5 31._____

32. .250 + 1/2 32._____

33. 2.875 + .125 - 3.0 33._____

34. 7/8 + .125 - 0.750 34._____

35. 1.015 + .625 - .045 35._____

H. Find the percentage:

36. 50% of 3 36._____

37. 5% of 3 37._____

38. 1% of 100 38._____

39. 6% of 500 39._____

40. 10% of 1,000 40._____

COURSE OF STUDY OUTLINE
MACHINE SHOP
APPLIED MATHEMATICS I

Specific Performances	Assignments
Unit I - Numbers	
Lesson 1. Meaning of Numbers	
a. Defines a *digit* as a *single number.*	a) Basic Vocational Math, Part I, page 2.
b. Defines a *unit* as a single *one.*	b) BVM-I, page 3.
c. Defines the *place value* of a number in terms of its position in relation to the *decimal point.*	
d. Places numbers in the proper numerical position. Groups the *numbers 1-9* in the *units* position.	c) BVM-I, pages 3 & 4
Groups *multiples* of *ten* in the *tens* position.	d) BVM-I, pages 5 & 6
Etc.	e) Lesson 1 - Quiz BVM-I, pp. 7-13 Handout I-1

Name_____

Date_____

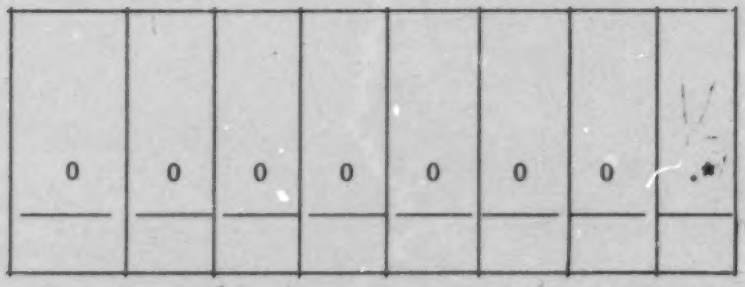
MACHINE SHOP
APPLIED MATHEMATICS I

Quiz - Unit I, Lesson 1

1. A digit is the same as (choose one)

a) a unit
b) a single number
c) a single object
d) any number of objects

2. Give the place value for the seven places preceding the decimal point.



Answer _____ *Decimal Point

3. There are_____units in the tens place.

4. There are_____tens in the hundreds place.

5. There are_____hundreds in the thousands place.

COURSE OF STUDY OUTLINE
MACHINE SHOP
APPLIED MATHEMATICS I

Unit I (continued)

Lesson 2 Reading and Writing Whole Numbers

a. Refers to any number group by name such as: units, tens, twenties, hundreds, and thousands.	a) BVM-I, pages 14-16
b. Arranges numbers in groups of three digits beginning from the decimal point and places a comma between each group.	b) BVM-I, pp. 17-19 BVM-I, p. 20, drill #1
	c) Lesson 2, Quiz - Basic Math Skills, pp. 3 & 4 prob. 1-10, prob. 31-38, prob. 42 and 43.

Lesson 3 Rounding Off Numbers

a. Defines rounding off as the simplifying of a number	a) BVM-I, pp.23 and 24.
b. Rounds off by selecting the desired place, omits all numbers to the right of that place, substituting zeros.	b) BVM-I pp. 24 (bottom)-26 (prob. 1-5 each)
If the last remaining number on the right is 1. Five or greater, adds 1 2. Four or less, leaves the same	c) Lesson 3 Quiz BVM-I p. 27 (1-5)

Lesson 4 Unit Test — a) Handout-Unit I test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit I - Test

Write the following numbers in numerals with commas inserted. (10 pts each)

1. Twenty-four 1. _____

2. One hundred thirty-five 2. _____

3. Two thousand, nine hundred and nine 3. _____

4. Fourteen million, six thousand and ten 4. _____

5. One hundred one thousand and one 5. _____

Round off the following numbers to the third place before the decimal.
(10 pts each)

6. 6,499 6. _____

7. 1,501 7. _____

8. 249 8. _____

9. 18,652 9. _____

10. 3,094 10. _____

Name: Applied Mathematics I

Evaluation sheet for - Unit I - Numbers

Lesson #	Title	Level				Comment
		A	B	C	D	
1	(Quiz -) Meaning of Numbers (Lesson 1)					
2	Reading & Writing Whole Numbers					
	Quiz - Lesson 2					
3	Rounding Off Numbers					
4	Unit Test					

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit II – Addition of Whole Numbers and Decimals

Lesson 1.	Introduction to Addition	
	a. Defines the numbers being added as the addend and the answer as the sum.	a) Basic Math Skills, p. 9
Lesson 2.	Addition Facts	
	a. Demonstrates memorization of the 100 primary combinations of the digits (0,1...9).	a) BMS, p 11, part 4A (This is a speed exercise; see your instructor before starting.) b) BMS, p 195, part A Quiz (see above instructions.)
Lesson 3.	Addition of Larger Numbers	
	a. Aligns the decimal point in a vertical column. b. Finds the sum of long columns.	a) Business and Consumer Math. pp.59-60. Work prob. 1-20 b) EBM, p. 16, work prob.1-13 c) BMS, p. 137, part A, prob. 1-10
Lesson 4.	Checking Addition	
	a. Uses the reverse-order method to check addition.	a) EBM, p. 13 b) BMS, pp 17-18 c) EBM, p. 16, part B
Lesson 5.	Unit Test	

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit II - Test

Find the sum; check your answers! Ten (10) points each.

1)
258.08
42.3
5.98
.005

2)
714.55
1489.92
29.76
3.251
.007

3)
3.750
49.25
.812
1.061
3.531

4)
.00425
.075
.750
8.62
.0625

5)
3.3125
.0313
.500
10.000
10.00015

6) 40.16 + 108.67 + 54.047 + 80

7) 2.8 + 9.04 + 16.009 + 28.1764

8) .58 + 95.4 + 16.009 + 1.007

9) 1.0025 + .7514 + .3095 + .2000

10) 1.062 + .438 + .500 + 1.312

Write answers here:

1)_____ 6)_____

2)_____ 7)_____

3)_____ 8)_____

4)_____ 9)_____

5)_____ 10)_____

Name: Applied Mathematics I

Evaluation sheet for Unit II — Addition of Whole Numbers & Decimals

Lesson #	Title	Level				Comment
		A	B	C	D	
1	Introduction to Addition					
2	Addition Facts (Quiz - Les. 2)					
3	Addition of Larger Numbers					
4	Checking Addition					
5	Unit Test					

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit III– Subtraction of Whole Numbers and Decimals

Lesson 1.	Introduction to Subtraction	
	a. Identifies the larger number as the minuend.	a) BMS, p. 27
	b. Identifies the number to be subtracted as the subtrahend.	
	c. Calls the answer the difference.	
Lesson 2.	Subtraction Facts	
	a. Demonstrates memorization of the 100 subtraction facts.	a) BMS, pp. 29-30 (This is a speed exercise; see your instructor before starting.) b) Lesson 2 Quiz BMS, p. 203 Quiz 12
Lesson 3.	Proving Accuracy	
	a. Uses the reverse-order method to check subtraction.	a) BMS, pp 31-32 b) EBM, p. 20, part C
Lesson 4.	Subtracting Decimal Fractions	
	a. Aligns decimal points vertically.	a) Math for Tech. & Voc. Schools pp. 40-41, prob. 1-10
Lesson 5.	Unit Test	a) Handout - Unit III Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit-III - Test

Subtract; check your answers. Ten (10) points each.

Problem:		Write answer here:
1.	55.007 - 3.05	1)_____
2.	406.810 - 53.918	2)_____
3.	508.71 - 49.028	3)_____
4.	612.8 - 320.806	4)_____
5.	3.007 - .479	5)_____
6.	87.31 - 9.025	6)_____
7.	737.658 - 402.78	7)_____
8.	200.4 - 89.997	8)_____
9.	486.273 - 35.106	9)_____
10.	271.43 - 58.7172	10)_____

Name: Applied Mathematics I

Evaluation sheet for Unit III Subtraction of Whole Numbers and Decimals

Lesson #	Title	Level				Comment
		A	B	C	D	
1	Introduction to Subtraction					
2	Subt. Facts Quiz - Lesson 2					
3	Proving Accuracy					
4	Subtracting Decimal Fractions					
5	Unit Test					

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed _____

Unit IV - Multiplication of Whole Numbers and Decimals

Lesson 1. Introduction to Multiplication

a. Uses multiplication as a short method of adding equal numbers.

b. Refers to the numbers involved in the multiplication as factors.

c. Refers to the answer as the product.

a) BMS, p. 43
b) Business & Consumer Arithmetic, pp. 24-25; read introductory statement only

Lesson 2. Multiplication Facts

a. Can demonstrate the 100 primary multiplication facts.

a) BMS, pp. 45-46. This is a speed exercise; see your instructor before starting.

Lesson 3. Multiplication with One-Digit Multipliers

a. Will carry figures where necessary.

a) BMS, pp. 47-48
b) Lesson 3 Quiz #20; BMS, p. Q211

Lesson 4. Multiplication with Two- and Three-Digit Multipliers

a. Will find partial products when multiplying by two or more digits.

b. Will indent partial products in solving for the product.

a) EBM, pp. 49-50
b) B&CM, p. 25, group 1
c) B&CM, pp. 25-26, group 2 (1-15)
d) Lesson 4 Quiz #21, BMS, p. Q211

Lesson 5. Multiplication with Zero in Either Factor

a. Knows that when zero is multiplied by any number the product is zero.

b. Knows that when any number is multiplied by zero, the product is zero.

a) EBM, p. 51 (see examples C & D) Work prob. #24-50
b) EBM, p. 52 (see examples C & D) Work prob. #24-50
c) Lesson 5 Quiz #22, BMS, p. Q213

Lesson 6. Shortcuts in Multiplication

a. Can, when multiplying by 10, 100, 1000, etc. move the decimal point in the multiplicand to the right as many places as there are zeros in the multiplier.

a) BMS, p. 57. Read first two paragraphs. Work prob. 1-40

b) Lesson 6, Quiz #25
BMS, p. Q215, part A

Lesson 7. Checking Multiplication

a. Will use the reverse-order method to check multiplication.

a) EBM, p. 25. See example of transposing factors

b) BMS, pp. 53-54 prob. 1-10 (use reverse-check method)

Lesson 8. Decimals in Multiplication

a. Will give the product as many decimal places as there are decimal places in the two factors together.

a) EBM, pp. 23-24 example 1&2

b) Math for Voc. & Tech. Schools, p. 42, prob. 2-8 set A, 2-8 set B, 21-40

Lesson 9. Unit Test

a) Handout - Unit IV Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit IV - Test

Multiply; check your answers. Five (5) points each.

1. 15 x 4	6. 78 x 14	11. 0.8 x 0.9	16. 18 x 100
2. 13 x 6	7. 86 x 11	12. 0.32 x 0.4	17. 92 x 1000
3. 11 x 8	8. 31 x 200	13. 0.25 x 0.375	18. 7.2 x 100
4. 51 x 10	9. 567 x 50	14. 3.1416 x 5	19. .063 x 100
5. 14 x 12	10. 52 x 4147	15. 0.813 x 4	20. .721 x 10

Write answers here:

1._____	11._____
2._____	12._____
3._____	13._____
4._____	14._____
5._____	15._____
6._____	16._____
7._____	17._____
8._____	18._____
9._____	19._____
10._____	20._____

Name: Applied Mathematics I

Evaluation sheet for Unit IV Multiplication of Whole Numbers & Decimals

Lesson #	Title	Level				Comment
1	Introduction to Multiplication					
2	Multiplication Facts					
3	Multiplication with 1-digit no. Quiz - Lesson 3					
4	Multiplication w/ 2&3 digit Multipliers. Quiz - Lesson 4					
5	Multiplication with Zero in either Factor. Quiz - Lesson 5					
6	Quiz - Lesson 6 Shortcuts in Multiplication					
7	Checking Multiplication					
8	Decimals in Multiplication					
9	Unit Test					

Evaluation:

A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit V – Division of Whole Numbers and Decimals

Lesson 1. Introduction to Division

a. Uses division as a short method of subtracting as reverse of multiplication.	a) BMS, pp. 61-62
b. Refers to division as a process used to determine how many times one number is contained in another.	
c. Can diagram a numbered line to illustrate division.	
d. Refers to the number to be divided as the dividend, the divisor as the number by which the dividend is divided, the number obtained as the quotient, and the amount left over as the remainder.	b) EBM, p. 28

Lesson 2. Division Facts

a. Will use the 90 division facts from memory.	a) BMS, pp 63-64. This is a speed exercise; see your instructor before starting.
b. Will not divide by zero.	b) Lesson 2, Quiz 26, BMS p.Q217

Lesson 3. Dividing With One-Digit Numbers

a. Will use division as the reverse of multiplication to find the answer.	a) BMS. pp. 65-66
b. Will multiply the answer by the divisor to check its equality to the number being divided.	b) Use the multiplication method to check the above assignment.

Lesson 4. Long Division

a. Will use zero in the quotient when the divisor does not "go".	a) BMS, pp. 67-68, prob. 1-7 b) Lesson 4, Quiz 28, BMS p.Q219 (check your answers)

Lesson 5. Dividing with Divisors Ending in Zero

a. Will cancel the zeros in the divisor and move the decimal point an equal number in the dividend.

a) EBM, pp. 30 bottom & top 31

b) Business & Consumer Math pp. 32-33, prob. 1-15

Lesson 6. Decimals in the Divisor

a. Will increase both the divisor and dividend proportionally.

a) Math for Voc. & Tech. Schools, p. 43, study section 2-9. Work 2-9 set A (skip 12 & 13). Work 2-9 set B, prob. 17-31.

Lesson 7. Unit Test

a) Handout - Unit V Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit V - Test

Divide; check your answers. Five (5) points each.

1. $30\overline{)21,840}$
2. $40\overline{)34,000}$
3. $58\overline{)26,796}$
4. $57\overline{)15,276}$
5. $462\overline{)267,036}$
6. 4896 ÷ 72
7. 20,640 ÷ 32
8. 5292 ÷ 21
9. 169 ÷ 13
10. 26,082 ÷54
11. 1000 ÷ 10
12. 2.75 ÷ 100
13. 2.75 ÷ .10
14. 3000 ÷ 100
15. 32,564 ÷ 1000
16. 535.65 ÷ 15.5
17. 78.425 ÷ 6.25
18. 97.34 ÷ 2.96
19. .857 ÷ 125
20. 37.625 ÷ 5.375

Write answers here:

1._____ 8._____ 15._____

2._____ 9._____ 16._____

3._____ 10._____ 17._____

4._____ 11._____ 18._____

5._____ 12._____ 19._____

6._____ 13._____ 20._____

7._____ 14._____

Name: Applied Mathematics I

Evaluation Sheet for Unit V Division of Whole Numbers & Decimals

Lesson #	Title	Level				Comment
1	Introduction to Division					
2	Division Facts: Quiz Lesson 2					
3	Dividing with 1-Digit Numbers					
4	Long Division: Quiz Lesson 4					
5	Dividing with Divisors Ending in Zero					
6	Decimals in the Divisor					
7	Unit Test					

Evaluation:

A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed _____

Unit VI – Common Fractions

Lesson 1. Introduction to Fractions

a. Refers to the term above the fraction line as the numerator.

a) Math for Tech. & Voc. Schools, pp. 1-2, sections 1-1 & 1-2 p. 3, section 1-3 set A, work prob. 1-6

b. Refers to the term below the fraction line as the denominator.

c. Defines a proper fraction as one with the numerator smaller than the denominator.

d. Defines an improper fraction as one with the numerator larger than the denominator.

Lesson 2 Reducing Numbers to Improper Fractions

a. Will solve mentally for the number of fractional parts of simple whole and mixed numbers.

a) Math for Tech. & Voc. Schools, p. 2 Sec. 1-3,example 1, p.3, section 1-3 set A, work prob. 7,8,9

b. Defines a mixed number as consisting of a whole number and a fraction.

b) Math for Tech. & Voc. Schools, pp. 2-3, section 1-3, p. 3 sec. 1-3 set A,work prob. 10

c. Converts the whole number of a mixed fraction to an equivalent improper fraction, then adds the fractional part of the mixed number.

c) Lesson 2 Quiz B&CA p. 42 bottom, work prob. #1-20

Lesson 3. Reducing Improper Fractions to Whole or Mixed Numbers

a. Divides the numerator of the improper fraction by the denominator to obtain a whole number, leaving the remainder as a proper fraction.

a) Math for Tech. & Voc. Schools, pp 3-4, sec. 1-4, work prob. 1-12 set A and 13-25 set B

b) Lesson 3 Quiz B&CA p.42 top, work prob. 1-25

Lesson 4. Reducing Fractions to Lowest Terms

a. Reduces the terms of the fraction so that each is prime to the other.

a) Math for Tech. & Voc. Schools, p. 4 sec. 1-5

b. Reduces by dividing the numerator and denominator by a common factor.

b) Math for Tech. & Voc. Schools, pp. 4-5 sec. 1-5, work prob. set A and 9-16 set B

c) Lesson 4 Quiz B&CA, p.44(1-20)

Lesson 5. Changing a Fraction to Higher Terms

a. Multiplies both terms of the fraction by the same number to achieve the required higher denominator.

a) Math for Tech. & Voc. Schools, p. 6, work sec. 1-6 set A

b) Lesson 5 Quiz B&CA, p.43 prob. 1-10

Lesson 6. Finding the Lowest Common Denominator of Two or More Fractions

a. Visually finds the lowest common denominator of shop fractions.

a) Math for Tech & Voc Schools, p. 7 sec. 1-7, see example (omit last 2 para) work set A, p. 8 prob. 1-11

b. Uses the product of prime factors to find the LCD when the lowest common denominator is *not visually* apparent.

b) Math for Tech & Voc. Schools, pp. 7-8. Study last two para. on p. 7. Study example 2 p. 8. Work prob. 11-24 of sets A&B

c) Lesson 6 Quiz BMS, p. 104 prob. 1-10

Lesson 7. Unit Test

a) Handout Unit VI Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit VI - Test Five (5) points each

Reduce to whole or mixed numbers in *lowest terms*.

1. 24/8 _____
2. 15/4 _____
3. 9/8 _____
4. 62/32 _____
5. 18/16 _____

Change to improper fractions.

6. 1½ _____
7. 3 1/8 _____
8. 1 1/8 _____
9. 1 3/16 _____
10. 6 3/4 _____

Change to the higher terms indicated.

11. 1/8 = ?/16 _____
12. 1/8 = ?/32 _____
13. 1/8 = ?/64 _____
14. 3/4 = ?/32 _____
15. ½ = ?/16 _____

Find the lowest common denominator.

16. 1/32, 1/16, 1/8, ¼
_____
17. ½, 2/3, 3/4
_____
18. 5/8, ¼, 1/16
_____
19. 7/8, 5/12, 3/16
_____
20. 1/100, 5/10, 3/1000
_____

Name: Applied Mathematics I

Evaluation sheet for Unit VI Common Fractions

Lesson #	Title	Level				Comment
1	Introduction to Fractions					
2	Reducing Numbers to Improper Fractions Quiz - Lesson 2					
3	Reducing Improper Fractions to Whole or Mixed No. Quiz Les. 3					
4	Reducing Fractions to Lowest Terms Quiz Lesson 4					
5	Changing Fractions to Higher Terms Quiz					
6	Finding the Lowest Common Denominator of 2 or more Fractions Quiz - Lesson 6					
7	Unit Test					
		A	B	C	D	

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit VII – Addition of Fractions

Lesson 1. Introduction

a. Will add only fractions of like denominators.

a) Math for Tech & Voc. Schools, pp. 8-9 sec 1-8, work prob. 13, 14, 15

b. Will add fractions of unlike denominators only after changing to equivalent fractions.

b) Math for Tech & Voc. Schools, p. 9, study the example and work set A&B except 13,14 or 15

c. Adds the numerators of the addends and writes this sum over the common denominator.

c) Lesson 1 Quiz BMS p. Q237 prob. 1-10

d. Reduces the resulting fraction to its lowest terms if not already so expressed.

Lesson 2 Addition of Mixed Numbers

a. Converts all mixed numbers to mixed numbers with common denominators, finds the sum and reduces to lowest terms.

a) Math for Tech & Voc. Schools, pp. 9-10, work sec. 1-9, set A&B prob. 29-32

b) Math for Tech & Voc. Schools, pp. 22-23, work prob. 1-6

c) Lesson 2 Quiz Math for T&V Schools, pp. 24-25, work prob. 7-11

Lesson 3 Unit Test

a) Handout - Unit VII Test

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MACHINE SHOP
APPLIED MATHEMATICS I

Unit VII - Test

Add, reduce to lowest terms. Seven (7) points each

		Write answers here:
1.	1/8 + 3/8 + 5/8	1._____
2.	1/16 + 3/16 + 15/16 + 7/16	2._____
3.	5/32 + 1/32 + 29/32	3._____
4.	¼ + 2/4 + 3/4	4._____
5.	6 3/64 + 2 5/64 + 61/64	5._____
6.	3/4 + 1/8 + 3/8	6._____
7.	7/16 + 1/32 + 3/4 + 1	7._____
8.	5/16 + ¼ + 3/64	8._____
9.	3 5/8 + 1/16 + 2 1/32	9._____
10.	15½ + 12 15/16 + ¼	10._____
11.	3 1/32 + 1½ + 2 3/4	11._____
12.	2 1/5 + 8 2/3 + 10 3/4 + 4 3/7	12._____
13.	6 7/16 + 7/8 + 2/3	13._____
14.	6 7/16 + 7/8 + 2/3 + 3 3/4	14._____
15.	4 + 11 3/5 + 7/8 + 3½	15._____

Name: Applied Mathematics I

Evaluation sheet for Unit VII Addition of Fractions

Lesson #	Title	Level				Comment
1	Introduction Quiz Lesson 1					
2	Quiz Lesson 2 Addition of Mixed Numbers					
3	Unit Test					

A	B	C	D

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed _____

Unit VIII - Subtraction of Fractions

Lesson 1. Introduction	
a. Subtracts only fractions with like denominators.	a) Math for Tech & Voc. Schools, pp. 10-11, example 1, work prob. 1-2 set A
b. Converts all fractions with unlike denominators to equivalent fractions before subtracting.	b) Math for Tech & Voc. Schools, p. 11, example 2, work prob. 3-12 set A
c. Reduces the result to lowest terms when not already so expressed.	c) Lesson 1 Quiz Math for T&V Schools, p. 11, work prob. 13-20
Lesson 2. Subtraction of Mixed Numbers	
a. Converts the fractional parts to equivalent fractions with a common denominator if not already so expressed.	a) Math for T & V Schools, p. 12, study example 1. Work prob. 1-5 set A
b. When necessary, borrows one from the whole number of the minuend, then adds the denominator to the numerator of the minuend.	b) Math for T & V Schools, p. 12, see example 2
c. Finds the difference and reduces to lowest terms	c) Math for T & V Schools, pp. 12-13, work prob. 6-12 set A. Pp. 26-29, prob. 12, 13, 28, 29
	d) Lesson 2 Quiz, work prob. 15, 16, 21, 22, 23, 24, set B
Lesson 3. Unit Test	a) Handout Unit VIII Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit VIII - Test

Find the difference. Reduce to lowest terms. Five (5) points each.

		Write answer here:
1.	3/4 - ¼	1._____
2.	½ - 1/5	2._____
3.	½ - ¼	3._____
4.	3/4 - 3/8	4._____
5.	3/5 - ½	5._____
6.	2/3 - ½	6._____
7.	5/6 - 2/3	7._____
8.	4/5 - 1/3	8._____
9.	8/9 - 2/3	9._____
10.	15/16 - 15/32	10._____
11.	6 - 1 3/8	11._____
12.	6 1/8 - 1 5/8	12._____
13.	4 5/16 - 1 1/16	13._____
14.	63/64 - 1/32	14._____
15.	1 7/8 - 3/32	15._____
16.	12 - 6 1/32	16._____
17.	18 5/32 - 5 3/64	17._____
18.	1 - 63/64	18._____
19.	63/64 - 7/8	19._____
20.	1½ - 13/16	20._____

Name: Applied Mathematics I

Evaluation sheet for Unit VIII Subtraction of Fraction

Lesson #	Title	Level				Comment
1	Introduction Quiz Lesson 1					
2	Quiz Lesson 2 Subtraction of Mixed Numbers					
3	Unit Test					

Evaluation:

A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit IX — Multiplying Fractions

Lesson 1. Multiplying Common Fractions

a. Finds the product of two or more fractions by placing the product of the numerators over the product of the denominator.	a) Math for T & V Schools pp. 13-15, examples 1-4
b. Reduces the terms of the fractions, whenever possible, before finding the product by dividing any pairs of terms by the same number.	b) Math for T & V Schools, pp. 14-15, examples 3 & 4; work prob. 1-8 set A and 13-16 set B, p. 16

Lesson 2. Multiplication of Mixed Numbers

a. Changes mixed numbers to improper fractions, and proceeds as with common fractions.	a) Math for T & V Schools, p. 15, see example 5; work prob. 9-12 set A and 19-23 set B, p. 16
	b) Math for T & V Schools, Lesson 2 Quiz prob. 20, p.27

Lesson 3. Word Problems in Multiplying Fractions

a. Substitutes the multiplication sign (x) for the word "of" in word problems.	a) Math for T & V Schools, pp. 15-16, example 6 & 7, work prob. 25-29, set C

Lesson 4. Unit Test — a) Handout Unit IX Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit IX - Test

Find the product; reduce to lowest terms. Five (5) points each.

		Write answers here:
1.	1/8 x 7	1._____
2.	3/4 x 2	2._____
3.	½ x ½	3._____
4.	3/8 x 5/8	4._____
5.	31/32 x 3/31	5._____
6.	5/64 x 2	6._____
7.	4 x 7/64	7._____
8.	1½ x 2	8._____
9.	4 5/8 x 3/4	9._____
10.	2 1/16 x 3 1/8	10._____
11.	2¼ x 3 1/16	11._____
12.	1 7/16 x 6	12._____
13.	3/4 of 12	13._____
14.	1/8 of 1	14._____
15.	5/8 of 8	15._____
16.	15/16 of 2	16._____
17.	½ of 3/4 x 2	17._____
18.	¼ of ¼ of ½	18._____
19.	1 2/5 x 3½ x 2	19._____
20.	12 3/8 x ½ x 3¼	20._____

Name: Applied Mathematics I

Evaluation sheet for Unit IX Multiplying Fractions

Lesson #	Title	Level				Comment
1	Multiplying Common Fractions					
2	Multiplication of Mixed Numbers Quiz Lesson 2					
3	Word Problems in Mult. Fraction					
4	Unit Test					

A	B	C	D

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit X – Division of Fractions

Lesson 1. Introduction		
	a. Uses division to find how many times one number is contained in another.	a) Math for T & V Schools, pp. 16-17, example 1 incl. the explanation. Examples 2 & 4; work prob. 1-7, 10 & 11 set A
	b. Changes the division problem to a multiplication problem to find the product.	
	c. Refers to the above process as "inverting".	
Lesson 2. Division of Mixed Numbers		a) Math for T & V Schools, p. 17, example 3; work prob. 8, 9,and 12-28
	a. Converts mixed numbers to improper fractions, sets the problem up as a multiplication problem and proceeds to find the product.	b) Lesson 2 Quiz 53 BMS, p. Q248, part B, prob. 1-10
Lesson 3. Division of Complex Fractions		
	a. Understands that a complex fraction is one in which the numerator or denominator or both are fractions or mixed numbers.	a) Math for T & V Schools, p. 19, examples 1 & 2
	b. Changes a complex fraction to a multiplication problem, then finds the product.	b) BMS, p. 127, work prob. 3,4,5
	c. Changes mixed numbers in complex fractions to improper fractions then proceeds as above.	c) Math for T & V Schools, p. 19, example 2, work prob. 2,3,4,5, 9 & 10, set A pp. 20-21
		d) Lesson 3 Quiz BMS p.Q247 quiz 54
Lesson 4. Unit Test		a) Handout Unit X Test

Name _____

Date _____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit X - Test

Divide; reduce to lowest terms. Five (5) points each.

Write answers here:

1. $4 \div 2/3$ — 1. _____
2. $9 \div 3/4$ — 2. _____
3. $15 \div 3/5$ — 3. _____
4. $20 \div 5/6$ — 4. _____
5. $2 \div 5/8$ — 5. _____
6. $3/4 \div 4$ — 6. _____
7. $6/11 \div 7$ — 7. _____
8. $\frac{1/3}{2/3}$ — 8. _____
9. $\frac{\frac{1}{8}}{3/4}$ — 9. _____
10. $\frac{5/8}{2}$ — 10. _____
11. $\frac{4}{3/4}$ — 11. _____
12. $\frac{15/16}{1\ 1/16}$ — 12. _____
13. $\frac{4}{2\ 1/8}$ — 13. _____
14. $\frac{7/16}{2}$ — 14. _____
15. $\frac{1\ 7/16}{4}$ — 15. _____
16. $\frac{12\ 2/8}{6\ 3/16}$ — 16. _____
17. $\frac{5\frac{1}{2}}{2\ 3/4}$ — 17. _____
18. $\frac{12\ 5/32}{3/8}$ — 18. _____
19. $\frac{8}{1\ 5/8}$ — 19. _____
20. $\frac{1\ 5/8}{8}$ — 20. _____

Name: Applied Mathematics I

Evaluation sheet for Unit X Division of Fractions

Lesson #	Title	Level				Comment
1	Introduction					
2	Division of Mixed Numbers Quiz Lesson 2					
3	Division of Complex Fractions Quiz Lesson 3					
4	Unit Test					
		A	B	C	D	

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit XI - Fraction Problems Involving Combined Operations

Lesson 1. Problems involving *only* multiplication & division

a. If the problem contains division, knows that the dividing fraction shall be converted to an improper fraction, inverted, and the problem solved as ordinary multiplication.	a) Math for T & V Schools, pp. 18-19, study the example given; work prob. 1-8, set A b) Lesson 1 Quiz Math T&V Schools, p 19, prob. 13-22 set B

Lesson 2. Problems involving addition and subtraction

a. Simplifies either or both the numerator and denominator by performing the indicated addition or subtraction first, then solving the remaining complex fraction.	a) Math for T & V Schools, pp. 19-20, see example 3; work prob. 6,7,8, set A and 13, 14, 15, 20, 21, 22 set B

Lesson 3. Unit Test

a) Handout Unit XI Test

Name_____

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MACHINE SHOP
APPLIED MATHEMATICS I

Unit XI - Test

Perform the indicated operations; reduce to lowest terms.
Ten (10) points each.

1. $\frac{3\frac{1}{2} \times 4\frac{1}{2}}{5 \times 2\frac{1}{4}}$

2. $\frac{\frac{1}{4} \div 1/8}{\frac{1}{2} \times \frac{1}{2}}$

3. $\frac{5/8 \times 3/8}{3/4 - 1/8}$

4. $\frac{7/8 - \frac{1}{4}}{3/4 \div 3/8}$

5. $\frac{7/8 \times \frac{1}{4}}{3/4 \div 3/8}$

6. $\frac{4\ 9/16 - 3\ 1/8}{2\frac{1}{4} + 1\ 3/16}$

7. $\frac{3\ 9/16 + 5\frac{1}{4}}{4\frac{1}{4} - 2\frac{1}{2}}$

8. $\frac{1\ 7/8 \times 3/4}{1\ 5/32 + 1\ 5/16}$

9. $\frac{2\ 1/8 + 3\ 1/32}{4\ 1/8 \div 4}$

10. $\frac{15/16 \times \frac{1}{2}}{2}$

Write answers here:

1._____ 6._____

2._____ 7._____

3._____ 8._____

4._____ 9._____

5._____ 10._____

Name: Applied Mathematics I

Evaluation sheet for Unit XI Fraction Problems Involving Comb. Operations

Lesson #	Title	Level				Comment
1	Problems Involving Only Multiplication & Division Quiz 1					
2	Problems Involving Addition and Subtraction					
3	Unit Test					

Evaluation:	A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit XII — Decimal Fractions

Lesson 1. Introduction

a. Defines a decimal fraction as any number to the right of the decimal point.	a) Math for T & V Schools, p. 30
b. Refers to any number group by name such as: .1 (one tenth), .01 (one hundredth) etc.	b) See "a" above; write prob. 1-8 set A and 9-16 set B

Lesson 2. Reducing a Decimal Fraction to a Common Fraction

a. Places the number over the denominator containing 1 and as many zeros as there are decimal places to the right of the decimal.	a) Math for T & V Schools, pp. 31-32, example 1-3; work prob. 1-15 set A and 17-24 set B
b. Reduces the common fraction to lowest terms.	

Lesson 3. Changing a Fraction to a Decimal

a. Divides the numerator by the denominator, carrying out to four places, and rounds off to three places.	a) Math for T & V Schools, p. 33, example 1; work prob. 1-20 set A, pp. 34-35

Lesson 4. Table of Decimal Equivalents

a. Will use shop-wall or pocket tables of decimal equivalents to convert common shop fractions such as 64ths, etc. to decimal fractions.	a) Math for T & V Schools, give answers to nearest 64th and in three decimal places; p 47: work prob. 5,8,16,24,25,26,27,28, & 33.

Lesson 5 Unit Test — a) Handout Unit XII Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit XII - Test

Using your decimal-equivalent tables, locate and give the appropriate decimal or fractional equivalent for each.

Time - Five (5) minutes; four (4) points each.

	Write answers here:		Write answers here:
1. ½	_____	14. .875	_____
2. 15/16	_____	15. .685	_____
3. 1/16	_____	16. .689	_____
4. 1/8	_____	17. .438	_____
5. 7/8	_____	18. .031	_____
6. 1/32	_____	19. .063	_____
7. 13/16	_____	20. .656	_____
8. 3/4	_____	21. .0156	_____
9. ¼	_____	22. .047	_____
10. 5/16	_____	23. .558	_____
11. 3/8	_____	24. .2812	_____
12. 15/32	_____	25. .109	_____
13. 3/64	_____		

Name: Applied Mathematics I

Evaluation sheet for Unit XII Decimal Fractions

Lesson #	Title	Level				Comment
1	Introduction					
2	Reducing a Decimal Fraction to a Common Fraction					
3	Changing a Fraction to a Decimal					
4	Table of Decimal Equivalents					
5	Unit Test					

	A	B	C	D
Evaluation:				

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit XIII - Percentage

Lesson 1. Definitions

a. Will define percent in terms of hundredths of a unit.	a) Math for T & V Schools, p. 53, section 3-1
b. Will define the symbol (%) as a way of writing hundredths in a percentage problem.	
c. Explains percentage as the product of base and rate.	

Lesson 2. Percent Equivalents

a. Changes percent to a decimal fraction by removing the percent sign and moving the decimal two places to the left.	a) BMS, p. 159 example A; work prob. 1-15, part A

Lesson 3. Finding Percentage

a. Converts the percent to a decimal fraction (the rate of percent) and multiplies this times the base.	a) Math for T & V Schools, pp. 53-55; work the even-numbered prob. 2-40, set A and 41,45,47, and 50 set B
b. Solves everyday percentage problems involving wages, taxes and payroll deductions.	b) EBM, pp. 211-212, see example 1-2; work prob. 1-4 p. 223. Math for T & V Schools, pp. 54-55, work prob. 42,43, 44,51, 52 Set B

Lesson 4, Unit Test

a) Handout Unit XIII Test

Name_____

Date_____

MACHINE SHOP
APPLIED MATHEMATICS I

Unit XIII - Test

Find the percentage. Ten (10) points each. Write the answers below:

1. 10% of 50 — 1._____
2. 10% of 500 — 2._____
3. 1% of 500 — 3._____
4. 100% of 25 — 4._____
5. 3.5% of 100 — 5._____
6. 6% of $10,000 — 6._____
7. 12.5% of $2,500 — 7._____
8. A man earns $4 per hour, works 40 hours, and has deductions from his pay of (a) 5.85% for Social Security, (b) 15% for income tax. What is his take-home pay? (Figure both taxes on his whole earnings.)
   8.(a) Social Security _____
   (b) Income tax _____
   (c) Take-home pay _____
9. The sticker price of a $4,200 car is discounted 15% by the salesman. What is the selling price? — 9._____
10. A man earns $4.02 per hour and receives a 5% raise.
    (a) What is his new hourly rate?
    (b) How much more per 40-hour week can he expect?
    10.(a) _____
    (b) _____

Name: Applied Mathematics I

Evaluation sheet for Unit XIII Percentage

Lesson #	Title	Level				Comment
		A	B	C	D	
1	Definitions					
2	Percent Equivalents					
3	Finding Percentage					
4	Unit Test					

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Introduction

MACHINE SHOP

APPLIED MATHEMATICS II

The specific performances listed in this outline are basic requirements for the machinist who makes his own set-ups and mathematical calculations involving angles, tapers, gear and pulley ratios, and indexing. The math skills mastered in these units open the door to the worker who plans to progress beyond the levels of the semi-skilled machine operator.

The outline is constructed for individual instruction. Only those students who have completed the requirements for Machine Shop I Mathematics may enroll. The individual who feels he has the necessary math background to earn credit for units contained in this outline may begin by taking and completing tests until he reaches his highest level of performance. An individual's instruction will start at that point and continue until he has mastered the performances outlined in Applied Mathematics II for Machine Shop.

Satisfactory completion of Part II provides the math skills needed to meet the performance requirements of the second class machinist classification. Only those students who meet both shop and Math II requirements will be recommended for employment as a second class machinist.

LIST OF TEXT AND REFERENCE BOOKS

MACHINE SHOP

APPLIED MATHEMATICS II

Basic Mathematics Simplified, C. Thomas Olivo. Delmar Publishers Inc.

Essential Mathematics, Frankford, Ulrich, and Clark. Harcourt, Brace and World, Inc.

Mathematics for Vocational and Technical Schools, Slade, Margolis and Boyce, John Wiley and Sons, Inc.

Machinery's Handbook, Erick Oberg and Franklin Jones. Industrial Press, Inc.

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Unit I - Ratio & Proportion

Lesson 1. Ratio

a. Writes a ratio as a comparison of two like quantities.	a) Math for T & V Schools, p. 61 section 4-1; work prob. 19-22 set B p.63
b. Writes a ratio as a fraction reduced to lowest terms.	b) Math for T & V Schools, pp. 61-62, see example 1 & 2; work prob. 1-8 set A
c. Obtains an inverse ratio by inverting the terms of the ratio.	c) Math for T & V Schools, p. 61, section 4-1; pp. 62-63, work prob. 9-16 set A; p. 62 prob. 18 set B
	d) Lesson 1 Quiz B&CA p. 107 prob. 1-8; give the inverse of the above problems; work prob. 1-4 p. 108

Lesson 2. Proportion

a. Writes one ratio equal to another to form a proportion.	a) Math for T & V Schools, p. 63, section 4-3
b. Selects the outside terms of a proportion as the extremes and the inside terms as the means.	b) Math for T & V Schools, pp. 63-64, section 4-3
c. Finds an unknown term by setting the product of the means equal to the product of the extremes.	c) Math for T & V Schools, pp. 64-67, see example 1-3. Work prob. 1,3,9,10,11, 15 set B
d. Solves for unknowns involving inverse proportion such as pulleys and gears as in "c" above after inverting the terms of the appropriate ratio.	d) Math for T & V Schools, p. 66, work prob. 6,7,8. B&CA p. 109, work prob. 1-5 p. 111
	e) Lesson 2 Quiz B&CA p. 109 prob. 1,2,4,5. Math for T & V School, pp. 351-352 prob. 1-5 set A

Lesson 3, Unit Test

a) Handout Unit I Test

Name_____

Date_____

MACHINE SHOP MATHEMATICS II

Unit I - Test

Write the ratio of the numbers below as a fraction. Reduce to lowest terms. (25 points)

Write answer here:

1. 15 : 3 — 1._____
2. 40 to 1 — 2._____
3. 1.5 to 3 — 3._____
4. 5 1/4 to 20 — 4._____
5. 1 : 1 — 5._____

Give the inverse ratio of each pair of numbers below. Reduce to lowest terms. (25 points)

6. 12 to 3 — 6._____
7. 4 to 9 — 7._____
8. 13 : 169 — 8._____
9. 1 : 2 — 9._____
10. 5.5 : 11 — 10._____

11. A machinist produces 5 pieces of work in 8 hours. How long must he work to produce 41 pieces? (10 points) 11._____

12. A coolant mixture for grinding work calls for a ratio of 40 parts water to one part soluble oil. How much oil is to be added to fifteen gallons of water? (10 points) 12._____

13. A drill feeds in a workpiece .010 inches per revolution. How far will the tool advance in one minute if it revolves at 300 revolutions per minute? (10 points) 13._____

14. A machinist earns $48 in 8 hours at straight rate. What are his earnings for Saturday work at time and one-half rate? (10 points) 14._____

15. A 3-inch-diameter pulley drives a 20-inch pulley. If the driving pulley rotates at 1750 RPM, then what RPM is the driven pulley operating at? (10 points) 15._____

16. What RPM can be expected of a 4-inch-diameter pulley if the 8½-inch-diameter driving pulley rotates at 200 RPM? (Bonus - 10 points) 16._____

Name: Applied Mathematics II

Evaluation sheet for Unit I Ratio & Proportion

Lesson #	Title	Level				Comment
		A	B	C	D	
1	Ratio; Quiz Lesson 1					
2	Proportion; Quiz Lesson 2					
3	Unit Test					

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit II – Squares, Square Root & Their Application

Lesson 1. Finding the square of a number.

a. Uses exponents to indicate a number is being squared.	a) Math for T & V Schools, pp. 78-79 section 5-5
b. Finds the square of a number by multiplying it by itself. itself.	b) Math for T & V Schools, pp. 79-80, work prob. 1,2,4,8,9, set A
c. Uses tables of squares to find the squares of whole numbers.	c) Find and list the squares of the numbers from 25 to 500 by 25s; example $25^2=625$ $50^2=2500$ etc.

Lesson 2. Finding the square root of whole numbers

a. Uses the square root sign to indicate square root is to be found.	a) Math for T & V Schools, pp. 79-80
b. Finds the square root of common exact squares visually.	b) Math for T & V Schools, p. 80; prob. 3,5,6,7, 10,11,12
c. Uses trial divisors in solving for square root when the answers are not visually apparent.	c) Math for T & V Schools, pp. 80-81
d. Uses square-root tables to find the square root of perfect squares and as a check for problems worked out.	d) Math for T & V Schools; work prob. 1-11, set A, p. 83 using tables at the end of the book

Lesson 3. Finding the square root of a fraction or mixed number

a. Converts fractional parts of mixed numbers to a decimal number.	a) Math for T & V Schools, p. 81, set up but don't work prob. 30,31,32,36 p. 84 set C
b. Divides the number into pairs to the right and left of the decimal point. Adds pairs of zeros as necessary to obtain the desired number of places after the decimal.	b) Math for T & V Schools, pp. 81-82 work prob. 30,31,32,36 p. 84 set C. Work prob. 13-18 p. 84 set B
	c) Lesson 3 Quiz Math for T&V Schools, p. 83, work prob. 6,8,9,10 set B section 5-7

Lesson 4. Application of square root

a. Can prove the Pythagorean Theorem in the solution of right triangles.

a) Math for T & V Schools, pp. 85-86

b. Finds the hypotenuse of a right triangle when given both sides by applying the formula:

$$c = \sqrt{a^2 + b^2}$$

b) Math for T & V Schools, p. 86 see example 1.Work prob. 1-14, set A pp. 88-89

c. Finds the altitude of a right triangle when given the base and hypotenuse by applying the formula:

$$a = \sqrt{c^2 - b^2}$$

c) Math for T & V Schools, p. 87, see example 2; work prob. 5-8 set A,p. 89

d. Finds the base of a right triangle when given the altitude and hypotenuse by applying the formula:

$$b = \sqrt{c^2 - a^2}$$

d) Math for T & V Schools, p. 88, see example 3.Work prob. 9-12 set A, p. 89

Lesson 5. Practical problems involving the solution of triangles

a. Uses the Pythagorean Theorem to find missing dimensions in the machining and inspection of a workpiece.

a) Math for T & V Schools, pp. 89-91, work prob. 13,14,16,19 p. 91

b) Lesson 5 Quiz work prob. 22 & 29, pp. 112-114

Lesson 6. Unit Test

a) Handout - Unit XV Test

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MACHINE SHOP
APPLIED MATHEMATICS II

Unit II - Test

Give the square of each number below. Five (5) points each.

Write answers here:

1. 9 _____
2. 15 _____
3. 3.50 _____
4. 6.312 _____
5. 10 3/4 _____

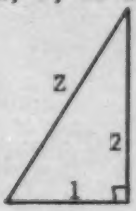
Find the square root to an accuracy of three decimal places. Five (5) points each.

Write answers here:

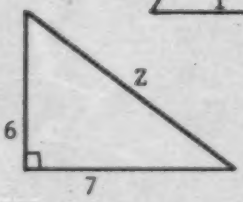
6. $\sqrt{169}$ _____
7. $\sqrt{225}$ _____
8. $\sqrt{7.625}$ _____
9. $\sqrt{11.250}$ _____
10. $\sqrt{.875}$ _____

Solve the following practical problems. Find the missing sides indicated by the letter X, Y, or Z. Ten (10) points each.

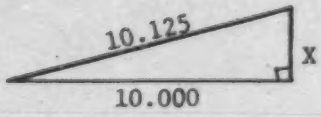
11.



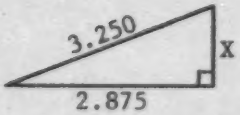
12.



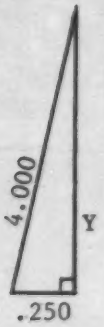
13.



14.



15.



11._____

12._____

13._____

14._____

15._____

Name: Applied Mathematics II

Evaluation sheet for Unit II Squares, Square Root & Their Application

Lesson #	Title	Level				Comment
1	Finding the Square of a Number					
2	Finding the Square Root of Whole Numbers					
3	Finding the Square Root of a Fraction or Mix.No.Quiz Les. 3					
4	Application of Square Root Quiz Lesson 4					
5	Practical Problems Involving the Solution of Triangles					
	Quiz Les. 5					
6	Unit Test					

Evaluation:

A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Unit III – Regular Polygons

Lesson 1. Introduction

a. Uses the work "polygon"to describe any closed plane figure having three or more sides.	a) Math for T & V Schools, p. 104, section 6-1
b. Understands that tables of constants are readily available in shop handbooks to shorten everday computations involving plane figures.	b) Machinery's Handbook, locate and list five (5) different figures for which formulas for areas and volume are given. What p. or pp. list this information? What formula is given for the diagonal of a square?

Lesson 2. Three-Sided Polygons (Triangles)

a. Defines a triangle having three equal sides as being equilateral.	a) Math for T & V Schools, p. 104, section 6-2
b. Uses formulas from the table of constants to solve problems involving equilateral triangles. Finds altitude knowing the length of one side. Finds area knowing one side. Finds side knowing altitude.	b) Math for T & V Schools, p. 105, study table of constants. See example 1, p. 106. Work prob. 1, set A; See example 2, p. 106. Work prob. 2, p. 107; work prob. 3, p. 107

Lesson 3. Four-Sided Polygons (Squares)

a. Defines a square as having four equal sides and 90-degree corner angles.	a) Math for T & V Schools, p. 107, section 6-3
b. Uses formulas from the table of constants to solve problems involving squares. Finds diagonal knowing one side. Finds area knowing one side.	b) Math for T & V Schools, p. 115, study Table of Constants. See example 1, p. 107, Work prob. 1, a-h set A; work prob. 2 a-h set A

Lesson 4. Six-Sided Polygons (Regular Hexagons)

a. Defines a regular hexagon as having equal sides and angles.	a) Math for T & V Schools, p. 108, section 6-4
b. Uses formulas from the table of constants to solve problems involving regular hexagons. Finds diagonal knowing distance across flats.	b) Math for T & V Schools, p. 105, study table of constants. Find the diagonal of ½, 5/8, 3/4, 1, 1¼, and 1½ inch hex stock using the formulas from the tables.

Lesson 5. Practical Applications of the Table of Constants

a. Uses the formulas listed in the table of constants to solve everday shop problems.	a) Math for T & V Schools, pp. 112-114, work prob. 21, 22, 24, 26, 27, 29. Give answers in three decimal places.

Lesson 6. Unit Test

a) Handout Unit XVI Test (Practical Shop Problems)

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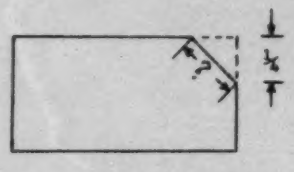
MACHINE SHOP
APPLIED MATHEMATICS II

Unit III - Test

Use the table of constants to solve the following common shop problems. Twenty (20) points each.

1. Find the flat of a ¼ inch x 45-degree chamfer.



2. What size square can be milled on the end of 1 1/8-inch round stock?

3. What diameter round stock is needed to mill a 1-inch hex on its end?

4. A triangular punch has equal sides 1.500 inches each. What is the measurement from base to top? Answer in three-place accuracy.

5. What is the area the above punch will remove in one stroke from a flat sheet during puching operations?

Write answers here:

1._____

2._____

3._____

4._____

5._____

Name: Applied Mathematics II

Evaluation sheet for Unit III Regular Polygons

Lesson #	Title	Level				Comment
1	Introduction					
2	Three Sided Polygons					
3	Four Sided Polygons					
4	Six Sided Polygons					
5	Practical Applications of the Table of Constants					
6	Unit Test					

Evaluation:	A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed _____

Unit IV - Circles

Lesson 1. Introduction

a. Defines circumference as the distance around a circle.

b. Defines radius as the distance from the center to the circumference.

c. Defines the diameter as a line across the circle thru the exact center.

a) Math for T & V Schools, p. 126, section 6-14

Lesson 2. Circumference

a. Defines π as a symbol representing a ratio of circle circumference to diameter.

b. Finds circumference knowing diameter using the formula:

$c = \pi D$

$\pi = 3.1416$ for machine-shop accuracy.

a) Math for T & V Schools, pp. 126-127, section 6-15

b) Math for T & V Schools, p. 127, work prob. 3-7, 9, 10, 12, 13, 17 set A. Give answers in three decimal places.

Lesson 3. Area

a. Multiplies π by the radius squared.

$a = \pi \cdot r^2$

$a = 3.1416 \cdot r^2$

a) Math for T & V Schools, p. 129, section 6-17, work prob. 4,5,6,11,13, 14, 15

Lesson 4. Areas of Ring Sections

a. Subtracts the area of the inner circle from the outside circle.

a) Math for T & V Schools, pp. 136-137, work prob. 1, 2, 4, 6, 9

Lesson 5. Unit Test

a) Handout Unit XVII Test Practical Shop Problems

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MACHINE SHOP
APPLIED MATHEMATICS II

Unit IV - Test

Twenty (20) points each.

1. A large steel casting is being turned on a vertical boring mill to 98.600 + .000
   - .020 inches diameter.
   How many feet of steel must the bit pass through each revolution?

   Answer_____

2. If the above casting weighs 90 pounds per foot of surface area on its end, what is the total weight?

   Answer_____

3. If a 30-inch diameter section is to be bored through a 48-inch diameter steel plate weighing 2.5 pounds per square inch, what will the remaining ring weigh?

   Answer_____

4. A sheet of metal must be machined so that when it is rolled it will form a tube exactly 24 inches in diameter. What is the exact width needed before rolling?

   Answer_____

5. Five bolt holes are being equally spaced on a 3.250 radius; what is the diameter of the bolt circle?

   Answer_____

Name: Applied Mathematics II

Evaluation sheet for Unit IV Circles

Lesson #	Title	Level				Comment
1	Introduction					
2	Circumference					
3	Area					
4	Area of Ring Sections					
5	Unit Test					

	A	B	C	D
Evaluation:				

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

COURSE OF STUDY OUTLINE

MACHINE SHOP MATHEMATICS II

Specific Performances	Assignments
Unit V - Arcs and Circles	
Lesson 1. Definitions	
a. Defines a *sector* as a pie-shaped section of a circle.	a. Math for V & T Schools, p. 139, section 6-24
b. Defines an *arc* as part of a circumference.	
c. Defines the angle formed by a sector as the *central angle*.	
Lesson 2. Finding the Length of an Arc	
a. Multiplies the circle's circumference by the ratio of the central angle to 360 degrees. $\text{Length of arc} = C \times \frac{\text{Central Angle}}{360^\circ}$	a. Math for V & T Schools, p. 139, see example 1. Work part (a) of Set A, p. 140, problems 1-10.
Lesson 3. Finding the Area of a Sector	
a. Multiplies the area of the circle by the ratio of the central angle to 360 degrees. $\text{Sector} = A \times \frac{\text{Central Angle}}{360^\circ}$	a. Math for V & T Schools, pp. 139-140, see example 2. Work part (b) of Set A p. 140, problems 1-10
Lesson 4 - Unit Test	Handout Unit Test

Name_____

Date_____

MACHINE SHOP MATHEMATICS II

Unit V - Test

Find the circumference to three decimal places.
Five (5) points each.

Write answers here:

1. 10" diameter — 1._____
2. .625" diameter — 2._____
3. 1.562" diameter — 3._____
4. 6'3" diameter — 4._____
5. 1" diameter — 5._____

Find the length of arc to three decimal places.
Five (5) points each.

6. 6" radius, 45° central angle — 6._____
7. 1/2" radius, 30° central angle — 7._____
8. 2.500 radius, 15° 30' central angle — 8._____
9. 1/4" radius, 135° central angle — 9._____
10. .625 radius, 270° central angle — 10._____

Twenty-five (25) points.

11. Find the length of a piece of sheet metal that must fit exactly around a 6-inch square that has 1-inch radius corners. — 11._____

Five (5) points each.

12.-16. Find the area of the sectors in problems #6-10 to two decimal places. — 12._____ 13._____ 14._____ 15._____ 16._____

Name: Applied Mathematics II

Evaluation sheet for: Unit V - Arcs and Circles

Lesson #	Title	Level				Comment
1	Definitions					
2	Finding the Length of an Arc					
3	Finding the Area of a Sector					
4	Unit Test					
		A	B	C	D	

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

COURSE OF STUDY OUTLINE

MACHINE SHOP MATHEMATICS II

Specific Performances	Assignments
Unit VI - Fundamentals of Trigonometry	
Lesson 1. Introduction to Right Triangles	
a. Can locate and identify the parts of the right triangle.	a. Basic Mathematics Simplified, p. 380 part A.
b. Can prove that in similar triangles, the ratio of sides to each other remains the same.	b. Essential Mathematics, p. 514, problems 1-10
	c. B.M.S., p. 382, work part A.
	d. Quiz - Lesson 1

Name_____

Date_____

MACHINE SHOP MATHEMATICS II

Quiz - Lesson 1, Unit VI

A. Draw a right triangle below measuring 3 x 4 x 5 inches. Make scale full size.
Label: Angles A, B, C
sides a & b
side opposite angle A
side adjacent to angle A
the hypotenuse "c"

B. Which angle is a right angle? (Circle the answer).
1. Angle A 2. Angle B 3. Angle C

C. Use the Pythagorean Theorem to prove the 3-4-5 triangle is a right triangle.

$(c^2 = a^2 + b^2)$

D. At the midpoint of line AC, draw a line perpendicular to AC and intersecting line AB.

1. What is the ratio of the *original* opposite and adjacent sides of angle A to each other?

2. What is the ratio of the *new* opposite and adjacent sides of angle A (in the smaller triangle formed)?

Does the ratio of part 1 differ from part 2? Yes. No.

Why?

Specific Performances	Assignments
Unit VI - (Continued)	
Lesson 2. Trig. Functions	
a. Can write the six terms used to express the ratios between sides.	a. B.M.S., pp. 380-381,part B. On the back side of a 3x5 card, *draw* a right triangle and label all its sides and angles by letters. On the lined side prepare and complete the table shown in part B, p. 382. Keep this card for continuing use.
b. Finds the tangent ratio by dividing the opposite side by the adjacent side. i.e. $\text{Tan } A = \frac{\text{Opp.}}{\text{Adj.}}$	b. E.M., p. 515, work problems 1-15.
c. Visualizes and draws a right triangle to find the tangent ratio when the acute angle is given.	c. E.M., p. 515, work problem #16.
d. Finds the cosine ratio by dividing the side adjacent by the hypotenuse. i.e. $\text{Cos } A = \frac{\text{Adj.}}{\text{Hyp.}}$	d. E.M., p. 522, work problems 1-8 and 32-40.
e. Finds the sine ratio by dividing the side opposite by the hypotenuse. i.e. $\text{Sin } A = \frac{\text{Opp.}}{\text{Hyp.}}$	e. E.M., p. 525, work problems 1, 14 and 15.

Name_____

Date_____

MACHINE SHOP MATHEMATICS II

Unit VI Test

1. Draw a right triangle below and label the angles, sides a, b, c, opposite side of angle A, adjacent side of angle A, and the hypotenuse. (50 points)

2. Fill in the missing information. The ratios are to be given for angle A. (50 points)

Side a	Side b	Hypotenuse	Tangent Ratio	Cosine Ratio	Sine Ratio
3	4				
	12	13			
8.000	6.000	10.000			
3.500		7.000			
	1.000	1.414			

Name: Applied Mathematics II

Evaluation sheet for: Unit VI - Fundamentals of Trigonometry

Lesson #	Title	Level				Comment
1	Introduction to Right Triangles					
	Quiz - Lesson 1					
2	Trig. Functions					
3	Unit Test					

Evaluation:

A	B	C	D

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____

Specific Performances	Assignments
Unit VII - Use of Trigonometric Tables	
Lesson 1. Finding the ratio corresponding to a given angle.	
a. For angles less than 45 degrees, reads down the trig. table. For angles 45 degrees to 90 degrees, reads up the trig. table.	a. Math for V & T Schools, pp. 284-285 Work set A prob. 1-20 Work set B, prob. 20-40 Use the trig. tables in the Machinery's Handbook.
Lesson 2. Finding an angle corresponding to a given function.	
a. Locates the ratio given under the appropriate function, and finds the corresponding angle.	a. Math for V & T Schools, pp. 286-287. See example 1. Work prob. 1-40. Use the Machinery's Handbook Tables.

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MACHINE SHOP MATHEMATICS II

Unit VII Test

Give the trigonometric ratio for the following angles.

1. Sin 30° _____
2. Cos 45° _____
3. Tan 60° _____
4. Tan 15° _____
5. Cos 75% _____
6. Cos 3° 16' _____
7. Sin 15° 32' _____
8. Tan 54° 12' _____
9. Cos 89° 48' _____
10. Sin 44° 13' _____

Give the angle for the following trigonometric ratios.

11. sin = .03926 Angle _____
12. sin = .75756 " _____
13. tan = .28674 " _____
14. cos = .29237 " _____
15. sin = .29237 " _____
16. sin = .50000 " _____
17. tan = 1.3270 " _____
18. tan = .72654 " _____
19. cos = .65166 " _____
20. sin = .83469 " _____

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Evaluation sheet for: Unit VII - Use of Trig. Tables

Lesson #	Title	Level				Comment
1	Finding the Ratio Corresponding to a Given Angle					
2	Finding an Angle Corresponding to a Given Function					
3	Unit Test					

Evaluation:	A	B	C	D

A - Lesson 25%
B - Quiz 25%
C - Test 50%
D - Unit Grade

Date completed_____

Specific Performances	Assignments
Unit VIII - Solution of Right Triangles	
Lesson 1. Obtaining Expressions	
a. Cross multiplies the function of the angle times the denominator of the ratio. Sets the numerator equal to the above cross-multiplication.	a. Math for V & T Schools, pp. 283-284, 289 (explanation - part 2). Develop the twelve expressions for angles A and B on a 3x5 card. Example: $\text{Sin A} = \frac{\text{opp}}{\text{hyp}} = \frac{a}{c}$ $\therefore a = \text{Sin A} \times c$ The symbol ($\therefore$) means therefore. Keep this card for continuing use!
	b. Quiz - Lesson 1 (Closed book)

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MACHINE SHOP MATHEMATICS II

Quiz - Lesson 1, Unit VIII

1. List the six possible ratios (trig. functions) for the angle A as in the example below.

   a. $\text{Sin A} = \frac{\text{opp}}{\text{hyp}} = \frac{a}{c}$

   b.

   c.

   d.

   e.

   f.

2. Develop an expression for the numerators of each ratio above. Write your answer in the space provided.

   Example:

   $\text{Sin A} = \frac{\text{opp}}{\text{hyp}} = \frac{a}{c}$ $\quad (\therefore a = \text{Sin A} \times c)$

   a.

   b.

   c.

   d.

   e.

   f.

Specific Performances	Assignments
Unit VIII - Continued	
Lesson 2. Solving Triangles Given an *Angle* and One Side	
a. Finds the unknown angle. Subtracts the given angle from 90°.	a. Math for V & T Schools, p. 287, example 1. Solve for the unknown angle in prob. 1-10, pp. 289-290.
b. Finds the unknown side and hypotenuse. Employs the appropriate expression from Lesson 1.	b. Math for V & T Schools, p. 289, see part 2 of the explanation for some examples. Complete prob. 1-10 pp. 289-290.
Lesson 3. Solving Triangles Given *Two Sides*	
a. Finds one unknown angle. Finds the tangent ratio of the sides and locates the corresponding angle in the trig. tables.	a. Math for V & T Schools, p. 290, see solution of Angle A Solve for Angle A, problems 1-10, set B, p. 291.
b. Finds the second unknown angle as in Lesson 2 above.	b. Math for V & T Schools, p. 290, see solution of Angle B Solve for Angle B, problems 1-10, set B p. 291.
c. Finds the hypotenuse. After solving for one angle, completes as in Lesson 2.	c. Math for V & T Schools, p. 291, problems 1-10, set B
	d. Quiz - Lessons 2 and 3

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MACHINE SHOP MATHEMATICS II

Quiz - Lessons 2 & 3, Unit VIII

Fill in the missing information. Use your cards of trig. functions and expressions, also the Machinery's Handbook for trig. tables.

---- Use three place decimals in answers.

---- Work to the nearest minute of angle.

Side a	Side b	Side c	Angle A	Angle B
7.000			24°	
	3.625			30°
		1.500	60°	
.625	.125			
1.500	2.500			

Specific Performances	Assignments
Unit VIII - Continued	
Lesson 4. Solving Triangles Given *One Side* and the *Hypotenuse*	
a. Finds one unknown angle. Employs the appropriate function of either sine or cosine to find the ratio and locates the corresponding angle in the trig. tables.	a. Math for V & T Schools, p. 291, see example 3 for Angle A. Solve for angle A in problems 1-10, set C
b. Finds the second unknown angle. Solves as in the previous problems.	b. Math for V & T Schools, p. 291, see example 3 for Angle B. Solve for angle B in problems 1-10, set C.
c. Finds the unknown side. Employs the appropriate expression from Lesson 1.	c. Math for V & T Schools, p. 291, solve for the unknown side in problems 1-10, set C.
Lesson 5 - Unit Test	Handout - Unit Test

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MACHINE SHOP MATHEMATICS II

Unit VIII - Test

Find the missing parts using the information given.
Use your cards of trig. functions and expressions to solve.
Use your Machinery's Handbook for the Trig. tables.
Answers to be three-place decimals.

Seven (7) points each part

Side a	Side b	Hypotenuse	Angle A	Angle B
		3.500	45°	
2.125			60°	
	6.187			10° 15'
.875	1.000			
	4.250	15.625		

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Evaluation sheet for: Unit VIII - Solution of Right Triangles

Lesson #	Title	Level				Comment
1	Obtaining Expressions					
	Quiz - Lesson 1					
2	Solving Triangles Given an Angle and One Side					
3	Solving Triangles Given Two Sides					
	Quiz - Lessons 2 and 3					
4	Solving Triangles Given One Side and the Hypotenuse					
5	Unit Test					
		A	B	C	D	

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed _____

Specific Performances	Assignments
Unit IX - Practical Applications of Trigonometry	
Lesson 1. Introduction to Taper Angles	
a. Defines the taper angle as the included angle formed either by the prolongation of the sides of tapered work or by the joining of sides of tapered work.	a. Math for V & T Schools, pp. 334-335. Make a simple drawing of the two conditions for taper angles. Label the taper angle.
Lesson 2. Computing the Taper Angle given Large and Small Diameters.	
a. Draws a line parallel to the center line from the small diameter to the larger diameter forming a right triangle equal to half the taper angle.	a. Math for V & T Schools, p. 335, example 1. Make a sketch of fig. 238 showing the right triangle formed.
b. Solves for the angle formed by the right triangle using the appropriate trig. function. Doubles this angle to find the included (taper) angle.	b. Math for V & T Schools, p. 335, example 1. Solve example 1. Work problems 2-4, 11 and 12.
Lesson 3. Computing the Taper Angle given Taper per Foot.	
a. Forms a right triangle as in Lesson 2. Finds the triangle altitude by taking one-half the taper per foot. Gives the length of the triangle base as 12 inches.	a. Math for V & T Schools, p. 336, example 2. Make a sketch of fig. 239. Work the solution yourself; compare your answer with the text.
b. Solves for one-half the taper angle using the above triangle and the appropriate trig. function. Doubles this angle to find the included (taper) angle.	b. Math for V & T Schools, p. 337. Work problem #1, p. 337, #14, p. 329, #15-21 c. Quiz - Lessons 2 and 3

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MACHINE SHOP MATHEMATICS II

Quiz - Lessons 2 & 3, Unit IX

Mathematics for Vocational & Technical Schools

Figure 234 on page 334 has a Brown and Sharpe Taper.

Find:

a. Small diameter "d" to three decimal places.

b. The taper angle to the nearest minute of angle.

Unit IX - Continued

Lesson 4. Problems Involving Isosceles Triangles

a. Drops a perpendicular line from the vertex angle to the base dividing the isosceles triangle into two equal right triangles.	a. Math for V & T Schools, pp. 292-294, examples 1 and 2
b. Uses the information given and the appropriate trig. procedure to find the vertex angle, altitude and base.	b. Math for V &T Schools, pp. 292-294. Work problems 1-5, set B, page 294. Make a sketch of each isosceles triangle, filling in the known values, then solve for the unknowns.
c. Applies the theory of isosceles triangles to the solution of common shop problems.	c. Math for V & T Schools, pp. 295-297. Work problems #6, 9, 13, 16, 17, 19 and 20.

Lesson 5. Problems Involving the Sine Bar in Inspection and Set-Up Work

a. Uses the sine tables to find the height of gage blocks needed to raise a 5-inch sine bar to a given angle.	a. Machinery's Handbook. Look up sine-bar in index. Find the gage-block height for the following angles: 1. 45° 00' 6. 12° 30' 2. 30° 00' 7. 29° 51' 3. 10° 18' 8. 42° 50'30" 4. 17° 21' 9. 22° 12'15" 5. 42° 58' 10. 15° 1'45"
b. Uses the table of sines to determine the angle being measured when the height of the sine bar is known.	b. Machinery's Handbook. Find the angle corresponding to the height of the sine bar below: 1. 3.5356 6. 2.5752 2. 2.5000 7. 0.26170 3. 3.3801 8. 1.0815 4. 2.2687 9. 1.295 5. 0.579 10. 3.105
Lesson 6 - Unit Test	Handout Unit Test

Name_____

Date_____

MACHINE SHOP MATHEMATICS II

Unit IX - Test

1. A taper pin 3 inches long measures .500 at its large diameter and .375 at the small diameter. What is its taper angle? 1._____

2. A shaft tapers down to .750 diameter and has a taper per foot of .250 inches. How long is the tapered portion? 2._____

3. Six holes are to be laid out on a 10-inch circle. What is the center-to-center distance of each pair? 3._____

4. To what height must a 5-inch sine bar be raised, to give an angle of exactly 30°? 4._____

5. A 5-inch sine bar must be raised to exactly 1.29410 inches to level a piece being inspected for its angle. What angle does the inspection show? 5._____

6. Extra credit: To what height must a 10-inch bar be raised in problem #4? 6._____

Name: Applied Mathematics II

Evaluation sheet for Unit IX - Practical Applications of Trig.

Lesson #	Title	Level				Comment
1	Introduction to Taper Angles					
2	Computing the Taper Angle Given the Large and Small					
	Diameters					
3	Computing the Taper Angle Given Taper per Foot					
	Quiz - Lessons 2 and 3					
4	Problems Involving Isosceles Triangles					
5	Problems Involving the Sine Bar in Inspection & Set-up					
6	Unit Test					
		A	B	C	D	

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed _____

Specific Performances	Assignments
Unit X - Computing Taper per Unit of Length	
Lesson 1. Computing Taper and Diameter	
a. Converts taper per inch to any other length in inches.	a. Math for V&T Schools pp. 324-325, see example 1.
b. Finds taper per inch (TPI) given taper per foot: $TPI = \frac{TPF}{12}$	b. Math for V&T Schools, p. 326, see example 2. Work problems 1-2, pp. 328-329.
c. Finds the taper per foot (TPF) given large and small diameters: $TPF = TPI \times 12$ or $TPF = \frac{D-d}{\ell} \times 12$	c. Math for V&T Schools, p. 326, see example 3. Work problems #5-7, 9-11 p. 329.
d. Finds the small diameter (d) given TPF, D. and ℓ: $taper = D - d$ $d = D - taper$ $d = D - \frac{TPF \times \ell}{12}$	d. Math for V&T Schools, p. 326, see Example 4. Work problems #14,16,18, 19,20, pp. 329-332.
e. Finds the large diameter given ℓ, d, and TPI: $taper = D - d$ $D = d + taper$ $D = d + (\ell \times TPI)$	e. Math for V&T Schools, p. 327, see example 5. Work problems #15,17,20
Lesson 2 - Unit Test	Hand out Unit X Test A

MACHINE SHOP MATHEMATICS II

Unit X, Test

Use the illustrations from the text: Mathematics for Vocational and Technical Schools pages 329 - 334.

1. Compute the small diameter of the lathe center in Fig. 220. The taper is Morse #3. 1._____

2. Compute the taper per inch and taper per foot on the mandrel in Fig. 228. 2.TPI = _____
2.TPF = _____

3. Find the small diameter in Fig. 234. Taper is #4 Morse. 3._____

4. The adapter in Fig. 231 has a 1/4-inch wall thickness and a #4 Morse taper. Find the large diameter of the outside taper. 4._____

Name: Applied Mathematics II

Evaluation sheet for Unit X - Computing Taper per Unit of Length

Lesson #	Title	Level				Comment
1	Computing Tapers and Diameters					
2	Unit Test					

A	B	C	D

Evaluation:

Lesson 25%
Quiz 25%
Test 50%
Unit Grade

Date completed_____